Enterprise Design Architecture: Optimization Technique

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Abstract- *WAN optimization accelerates enterprise applications, improves backup and recovery times and reduces bandwidth and infrastructure costs by prioritizing business-critical functions, applying intelligent compression algorithms to site-to-site and mobile traffic and eliminating the transmission of redundant data across wide area networks. Leveraging stream-based differencing, application blueprints, single instance store, traffic prioritization and network, application and TCP optimizations, Array WAN optimization solutions mitigate the effects of limited bandwidth, high latency, packet loss and network congestion to improve application response times by more than 50x and reduce bandwidth utilization by up to 95%.*

Keywords- Router Optimization, WAN, Traffic analysis, Bandwidth Prioritization

I. INTRODUCTION

The growing faith of recent enterprises on high-bandwidth applications and cloud services makes a new task for operators of wide area networks (WANs). These systems, which are used to interconnect division offices and data centers around the world, must bear the burden of carrying high-volume traffic with low latency. Similarly, local area networks (LANs) that carry traffic over smaller areas, such as an office building, also face bandwidth demands from advanced applications. Network optimization technologies allow entities to avoid these costly investments by making better use of existing bandwidth and allowing organizations to deliver applications and cloud services more efficiently [10]. WAN optimization technology uses data deduplication, traffic prioritization and other techniques to facilitate the efficient transmission of high-priority data. Application optimization methods attempt to reduce the amount of data generated by applications in the first place by implementing server and application improvements.

II. WIDE AREA NETWORK (WAN)

WAN is computer network over a great environmental area and frequently constructed by hired telecommunication circuits. Each computer in each workplace has applications for user and is named as a host. The network that linked the hosts is called subnet. The duty of the subnet is to transmit messages from host to host, as the telephone system transmits the words from the speaker to the listener [6]. In most WANs, the subnet consists of two distinct components: line transmission and switching elements [7]. The transmission line moves bits between machines. They can be made from copper wires, fiber optics, or even radio links. Most companies do not have transmission lines, so they leased line from telecommunication companies. When data arrives in the incoming path, the switching element must specify an exit path to forward the data [8]. This switching computer is now better known by the name of the router.

III. WAN OPTIMIZATION

The goal of WAN optimization is to increase performance of data transfer over wide area networks [7]. For that purpose there are several techniques in WAN optimization such as Deduplication, Compression, Web Caching, Wide Area File Services (WAFS), and Forward Error Correction (FEC). Here we primarily focus on compression and web caching.

A. Compression

The basic idea is to reduce data size therefore it will save space, bandwidth and time to transmit. This data compression occurs only on the WAN path and then decompressed automatically after receiver receives the data. This will certainly save more space on the WAN path for other packages so as to make the network more efficient. The compression can be used for network with topology point-to-point leased lines. One of the concept to compress the data is by remove all extra character, denoting a string of recurrent characters through insertion of a single repeat character, and also the word that occur often can be substituted with a single character.

B. Caching

Caching is necessary if there is accessing the same data or site over time thereby reducing the same repetitive packet delivery, since the caching server has the ability to store frequently requested information. Therefore, web caching can help to reduce and save bandwidth, and also make more efficient in transmission of data over the WAN. One of the shortcomings of caching is the risk of providing non-update data. If we access the current cache page, then it is at risk of getting incorrect and stale information. Most browsers can actually perform their own caching mechanisms. Many web servers store time stamps from their last update, then the browser uses a cached copy of the remote page after checking the time stamp.

IV. BANDWIDTH DILEMMA

The one way that many IT managers of these companies try to address poor WAN performance is simply due to consumption of large amount of bandwidth for the farthest distance connections among data centers and branch offices, but it's not the necessarily the correct way as bandwidth is very expensive. So how to frame this network, such that the organization funding becomes agreeable.

Criteria's involved in WAN optimization

Whenever the concept of WAN is chosen then there are some prerequisites that are taken into the account like Architecture and blueprint of network (Head office with other Branches), Cable used (Cat e5, 6 within organization, Fiber optic cable interlink the branches, Core switches), Model of Router, Model of Switches (Layer 2 or 3), capacity of the organization, Application that will Perform on live environment including network security like ISA, Servers, Data Base. Now after checking all these parameters, the calculations among them are carried out in the following way:

1) Network Bandwidth consumed = TB– TC

T.B = Total Bandwidth provided by ISP
T.C = Total bandwidth utilized by the organization during peak time and weekends/non-working hours

2) Percentage of data loss = Data Loss / Total Data transmitted *100

For instance:
Data Loss =10000Kbps
Data transmitted = 2500Kbps
Now% of Data Loss=10000/2500*100=4000% (Ratio becomes 4:1)

3) Network Performance = Data transmission over Fiber optic + Data Transmission over Cat 6/5e cables
Data transmission = Total data transmitted – Data loss.

4)% of network performance = Total Data transmission/ Total bandwidth provided * 100

These are some of the criteria's that will help Infrastructure team to construct the network initially and put some of the operations of an application on live to get an idea on the network utilizing as a system. Based on the whole analysis of network performance, help them to configure the WAN Optimizer that will turn, accelerate the performance of the operations that are performing live.

V. WAN PERFORMANCE ISSUE

If applications across the WAN are performing poorly, mostly IT administrators assume the problem to be constrained bandwidth. But this analogy is flawed and WAN performances issued around several factors:

A. Centralization and Response Time

The distance between a central data center and a branch office often means that applications under perform. It takes some time for the packets to travel. This network latency combined with low bandwidth and inefficient web applications to create sluggish applications, which leads to endless file transfers.

B. Chatty Protocol

When a protocol sends data in small, sequential steps over the network, that protocol is known as chatty. To avoid the loss of data packets, these protocols chop up the data into lots of little packets.

C. Latency

Latency is defined as the time interval between source and destination. Increasing the bandwidth won't solve latency and chattiness problems. Often, the problem isn't bandwidth but latency. So, optimizing latency can include TCP refinements such as window-sizes scaling, selective acknowledgements, and even co-location arrangement in which application is placed in nearer adjacent endpoint to reduce latency. Also the outsourced staff and remote business partners need to provide secure access limited to only the resources they require.

VI. OPTIMIZATION SOLUTIONS FOR OFFICE / DATA CENTER CONNECTIONS

Our solutions are aimed at effective use of WAN. The concept of SDN is applied to WAN in order to integrate physical networks and to enable the virtualization of corporate networks. Then, end user devices of each office are divided into two groups according to the usage priority of the business system.

Next, the virtualized corporate network is built while being divided into two categories of priorities - high and regular. Finally the priority controls and bandwidth controls for each virtual network as well as the communication path control for each flow (the packet flow of each business application in the communications between terminals) are carried out. Such functions have achieved the effective usage of bandwidth and optimal efficiency of communication line fee [11].

Moreover, these solutions achieve network visualization through the centralized control of both physical and virtual networks in order to control traffics per flow-base. System maintenance can also be performed easily; thereby operators enable to modify the system without referring to configuration files [11]. This means that operations may be conducted by an operator that has not yet gained advanced technical proficiency. Therefore, our solutions are effective for high-cost communication line.

VII. SOLUTION FEATURES

The main features of the "WAN connection optimization for offices and data centers" include the following two improvements:

1) Efficiency of WAN line usage and
2) Efficiency of WAN operation management by using network virtualization. The details are described below.

A. Improvement in the efficiency of WAN line usage

The physical networks are integrated; corporate networks are virtualized and applied a priority control in two-level with each virtual network. This makes it possible to use the connection line under the active/active configuration so that the efficient usage of line capacity can be achieved [11]. Moreover, the operation control system enables the communication route control according to the time of day and communication line usage (for example; batch processing at night, ensuring enough bandwidth for business systems whose service time is fixed, prevention of deterioration in the response time by rerouting traffic when traffic volume is increased, etc.) Thus, improvement in the utilization of communication lines and bandwidths, improvement in line fee efficiency and the stable operation of network response time may be achieved.

B. Improvement in the efficiency of WAN operation management

With regard to traffic monitoring, it is often not performed at all or is executed only by limited number of ports. As a result, it takes much time to solve the performance incident such as "response time deterioration", "no response from a certain business application" or "LAN looping occurrence", etc. Applied to the SDN technology, centralized control of both physical and virtual networks is now possible, and both physical and virtual networks are now visualized [11]. Therefore, the conditions of failures and rerouting of each business/division system can be confirmed with a simple operation. The system operator who does not have deep technology skills and knowledge can operate and manage this network system, so that even IT system operator can do it. Moreover, it allows operator to control traffics per flow, so that the performance incident, which used to require much time to be solved, can now be dealt with smoothly. This solution enables reduction of both cause analysis time and the number of related processes.

VIII. CONCLUSION

These solutions will significantly change the way to use communication lines of telecom carriers in a corporate WAN, and improve the effective line resources usage, thereby achieve the communication line fee improvement. This solution will meet the social needs where there is a tendency toward increased traffic flows. We believe that this solution will contribute to the realization of a secure, safe, efficient and flourishing society.

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